



Looking at environmental justice from an environmental health perspective

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Although scientific evidence is scarce and uneven, there are mounting concerns that environmental health risks are borne disproportionately by members of the population who are poor and nonwhite. From an environmental health perspective, research to reduce critical uncertainties in health risk assessment must necessarily be at the heart of efforts to evaluate and resolve issues of environmental justice—helping to define the dimensions of the problem, understand its causes, and identify effective and efficient solutions. The full range of environmental health sciences, including exposure analysis, epidemiology, toxicology, biostatistics, and surveillance monitoring, is needed to build a strong scientific foundation for informed decision making. This is the best and surest way to promote health and safety for all members of our society, regardless of age, ethnicity, gender, health condition, race, or socioeconomic status.

Keywords: *environmental health, environmental justice, exposure assessment, risk assessment, risk management, susceptibility.*

Introduction

As the twentieth century draws to a close, 'environmental justice' is both a nationally prominent public policy issue and a catalyst in the ongoing debate about societal values (Sexton and Zimmerman, 1999). Does everyone have an equal right to protection from environmental hazards and associated risks? To what extent should those who derive benefits from polluting technologies and activities also bear the costs? Should the burden of proof be on industry to show that a new product is safe, or on government to show that it is harmful? How do we make necessary tradeoffs between the often conflicting policy goals of efficiency (aim to maximize the difference by which benefits exceed costs) and equity (aim to ensure evenhanded distribution of costs and benefits)? Answering these kinds of questions goes to the heart of the matter—what kind of a society do we want to live in?

Although environmental justice remains an emotionally charged and ill-defined concept, virtually everyone agrees it is an appropriate societal goal. This consensus quickly erodes, however, when the discussion turns to practical questions (Weisskopf, 1992; Cushman, 1993, 1998; Meersman, 1997). What do we mean by environmental justice? What changes are necessary to attain this objective? How do we measure progress? Thus, our society finds itself in the awkward position of trying to put environmental justice principles into practice while at the same time debat-

ing the meaning of the term and its implications for decision making (Greenberg, 1993; Been, 1994; Zimmerman, 1994; Cushman, 1998; Sexton and Zimmerman, 1999).

Examples of some of the different ways environmental justice has been defined in the past are provided in Table 1. These definitions incorporate, either implicitly or explicitly, a variety of ethical, moral, philosophical, and political judgments about fairness, equity, and justice. In doing so, they demonstrate the fundamentally complex and difficult questions that must be addressed at both the conceptual and operational levels if we are to make progress toward the goal of environmental justice. Reasonable and realistic answers to these key questions will necessarily require prudent blending and balancing of relevant facts and important values.

Today, environmental justice is at the forefront of the nation's environmental policy agenda (Clinton, 1994; U.S. Environmental Protection Agency, 1994, 1998), and related policies and programs are being implemented at federal, state, and local levels (Cushman, 1998; Sexton and Zimmerman, 1999; U.S. Environmental Protection Agency, 1998). Through actions by the courts, the executive branch, the Congress, and the states, environmental justice concerns are gradually being incorporated into the fabric and structure of everyday environmental decisions. But environmental justice remains a conspicuously political and increasingly litigious topic, raising the question of whether science can make a difference in such a politicized, value-laden debate.

In this article, environmental justice is put in the context of risk-based decision making. From this perspective,

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**Table 1.** Selected examples of definitions for environmental justice

- Environmental justice is a societal goal, defined as the provision of adequate protection from environmental toxicants for all people, regardless of age, ethnicity, gender, health status, social class, or race (Sexton and Anderson, 1993a).
- The environmental justice framework... rests on an ethical analysis of strategies to eliminate unfair, unjust, and inequitable conditions and decisions... [It] incorporates the principle of the right of all individuals to be protected from environmental degradation; adopts a public health model of prevention (that eliminates the threat before harm occurs) as the preferred strategy; shifts the burden of proof to polluters/dischargers who do harm, discriminate, or who do not give equal protection to racial and ethnic minorities...; and redresses disproportionate impact through 'targeted' action and resources (Bullard, 1993).
- Environmental justice is about social transformation directed toward meeting human need and enhancing the quality of life—economic equality, health care, shelter, human rights, species preservation, and democracy—using resources sustainably. A central principle of environmental justice stresses equal access to natural resources and the right to clean air and water, adequate health care, affordable shelter, and a safe workplace (Hofrichter, 1993).
- Environmental justice seeks to ensure that no population is forced to shoulder a disproportionate burden of the negative human health and environmental impacts of pollution or other environmental hazards (U.S. Department of Health and Human Services, 1995).
- Environmental justice refers to those cultural norms and values, rules, regulations, behaviors, policies, and decisions to support sustainable communities; where people can interact with confidence that their environment is safe, nurturing, and productive. Environmental justice is served when people can realize their highest potential, without experiencing the 'isms' [e.g., racism]. Environmental justice is supported by decent paying and safe jobs; quality schools and recreation; decent housing and adequate health care; democratic decision-making and personal empowerment; and communities free of violence, drugs, and poverty (Bryant, 1995).
- [Environmental justice is] The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies (U.S. Environmental Protection Agency, 1998).

environmental justice is seen as a consequential and legitimate environmental health issue, which deserves greater attention from the research community. The following discussion describes the rationale for targeted scientific research to improve our knowledge and understanding of the differential effects of class and race on pollution-related health risks.

Framing environmental justice in terms of environmental health risk

A primary goal of health risk assessment is to identify and evaluate those populations, subpopulations, and individuals

at highest comparative risk so that, if warranted, appropriate mitigation actions can be implemented. Conceptually, individuals and groups are deemed to be at potentially greater risk when they are (a) exposed above some health-related benchmark or (b) more susceptible to the adverse effects of exposures. Those who are both more exposed and more susceptible are at highest risk. A growing body of evidence indicates that low-income groups, a disproportionate percentage of which are people of color, tend to be both more exposed to many environmental pollutants as well as more susceptible to related health effects than the general population (U.S. Environmental Protection Agency, 1992; Sexton and Anderson, 1993b; Sexton, 1997). What is not apparent is the extent to which differential pollution risks contribute to higher rates of morbidity and mortality among poor people and ethnic and racial minorities.

Association Between Class and Race and Health Status

Rates of disease and death in the United States vary substantially by social class and ethnicity/race. Both are predictors of health status, and both are associated with susceptibility factors, such as access to health-promoting and health-protecting resources (e.g., healthy diet and sanitation) and preventative medical practices (e.g., prenatal care and childhood immunization), as well as lifestyle choices about alcohol and tobacco use, sexual behavior, and occupation. Socioeconomic status (SES) is known to be a critical risk factor affecting morbidity and mortality (Williams and Collins, 1995). Yet despite its apparent importance, the mechanisms by which SES exerts its influence are largely a matter of conjecture. Similarly, the influence of ethnicity/race on health status is also well known and, as with SES, the causal relationships are poorly understood (Williams and Collins, 1995). The situation is complicated by the fact that ethnicity/race is associated with both absolute and relative poverty. Consequently, it is often difficult to distinguish the separate effects of class and race on health (Williams and Collins, 1995; Sexton, 1997).

Health status is clearly a product of multiple variables, many of which are poorly understood. There is substantial evidence suggesting that large-scale social factors are the primary determinants of health—determining not only individuals' social class but also their access to resources and exposure to risk factors (Williams and Collins, 1995). However, the precise mechanisms by which position in the social structure is causally related to health status are not well elucidated. Currently, there is mounting evidence that disparities in health status between higher and lower SES strata are increasing, and that the health of some racial groups is steadily deteriorating. These realities moved Williams and Collins (1995) to observe that "Racial and socioeconomic inequality in health is arguably the single most important public health issue in the United States."



Association Between Class and Race and Pollution Risks

Observed differences in health status by socioeconomic class and ethnic/racial group raise questions about the possible role of environmental pollution in the context of other societal factors influencing health. From a risk-based perspective, we need to know whether environmental health risks vary by class and race, and, if so, the extent to which differential environmental health risks contribute to higher rates of morbidity and mortality among economically disadvantaged groups. Answers to these and related questions will then allow us to intervene effectively to prevent or mitigate those environmental health risks deemed unacceptable.

Unfortunately, there is a chronic shortage of scientific evidence to answer these and other relevant questions with an acceptable degree of certainty. A major problem in this regard is the inherent difficulty of demonstrating the existence of a causal relationship between exposure to hazardous environmental agents and subsequent disease or injury unless the link is strong (e.g., radon-induced lung cancer in uranium miners) or the population is large (e.g., leukemia from benzene exposure). Therefore, attempts to answer the risk-related questions posed above are ham-

pered not only by complexity and uncertainty surrounding the major determinants of health, and by variations of these determinants according to class and race, but also by difficulties intrinsic to establishing a causal link between environmental exposures and ensuing adverse health effects (Sexton, 1997).

One way to think about the hypothesized, though as yet largely unexplored interrelationships among class and race, exposure- and susceptibility-related attributes, and environmental health risks is depicted in Figure 1 (Sexton et al., 1993). This conceptual model allows us to postulate how social class or racial group might be related to higher-than-average health risks. It highlights three questions that are important for risk assessment and risk management: (1) How do important exposure- and susceptibility-related attributes affect environmental health risk? (2) How do class and race affect important exposure- and susceptibility-related attributes? (3) How do class and race differentially affect environmental health risks?

Resolution of the first question allows for realistic assessment of environmental health risks encountered by those at potentially greater risk. Answers to the second question provide an indication of whether certain socio-

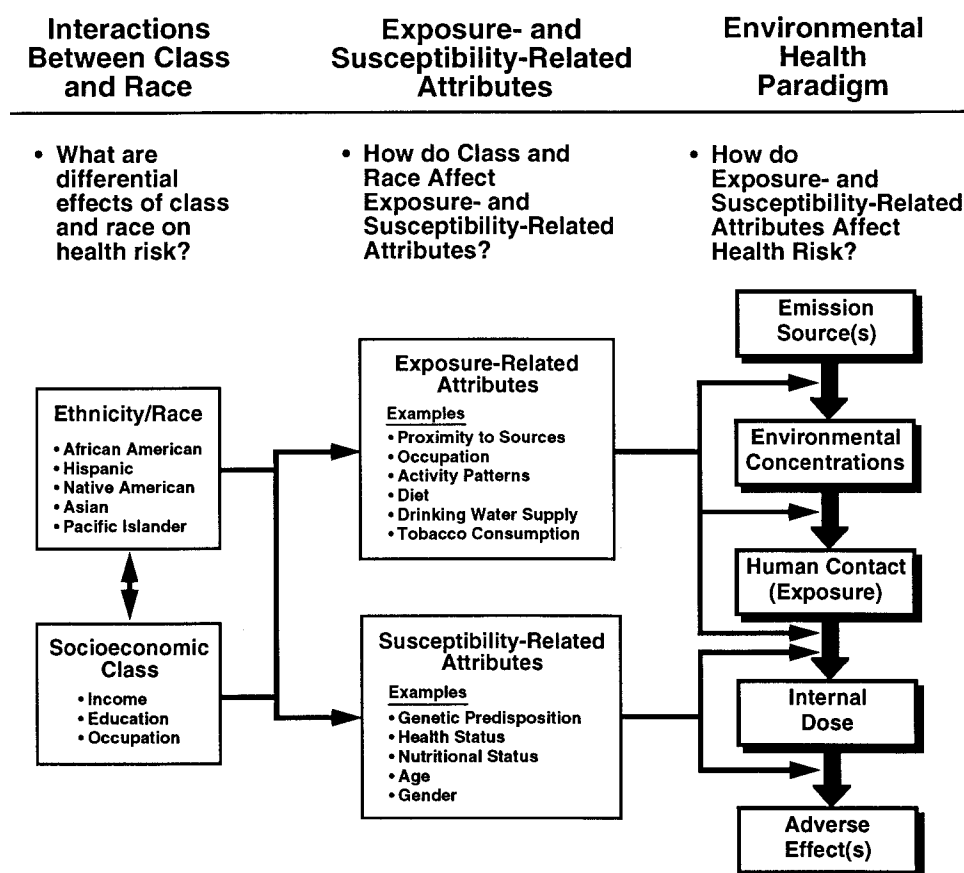


Figure 1. Conceptual model for the relationships between sociodemographic variables (i.e., socioeconomic status and ethnicity/race) and environmental health risks (from Sexton et al., 1993).



demographic groups are disproportionately represented in at-risk categories. And answers to the third question elucidate some of the interrelationships among class and race, affording an opportunity to distinguish the relative influence of each on environmental health risks. These three questions are not independent of one another. Answers to the first question allow us to raise the second and, taken together, answers to the first two questions let us draw some tentative conclusions about the third (Sexton et al., 1993).

Reasons for Concern

Although the existing scientific database is fragmented, uneven, and sparse, there is good reason to suspect that economically disadvantaged populations, including a disproportionate percentage of ethnic and racial minorities, are more exposed to many environmental agents and more susceptible to related adverse effects than the general population. Many observational studies conducted over the past several years have found that poor people, and especially poor blacks and Hispanics, are more likely than affluent whites to live near environmental hazards, such as waste sites, reside in urban areas where ambient levels of many air pollutants tend to be higher, eat significantly greater amounts of contaminated fish, and be employed in potentially dangerous occupations (e.g., migrant farm work). At the same time, substantial evidence suggests that these same groups are likely, on average, to be more vulnerable to environmentally induced dysfunction, disability, disease, and death. Poor people and people of color are more likely to lack knowledge about environmental health issues, to have a substandard diet, to lack access to adequate health care, to smoke cigarettes and drink alcohol and, in general, to live more stressful and less healthful lives (U.S. Environmental Protection Agency, 1992; Sexton and Anderson, 1993b; Sexton, 1997).

Implications for risk assessment and related research

In the parlance of public health, class (low income, inadequate education, blue collar job) and race (African American, Native American, Southeast Asian) are 'risk factors' for certain kinds of exposures and susceptibilities to pollution hazards (as well as related health risks). Traditionally, however, the field of environmental health sciences has not focused much attention or devoted many resources specifically to issues of class and race. There is, consequently, a scarcity of reliable information on which to base risk estimates for low-income and minority populations, despite mounting evidence that class and race matter for realistic risk assessment (Sexton, 1997).

Kuehn (1996) has observed that this lack of relevant data leads to a built-in, systematic bias in risk assessment,

which hinders recognition that, in many cases, economically disadvantaged groups bear a disproportionate burden of risk. He is concerned about quantitative risk assessment squeezing out factors that cannot be (or have not been) quantified, thereby giving more credence and weight to tangible factors that can be (or have been) measured, at the expense of less tangible, less-easily-measured, though not necessarily less important, non-quantifiable (or not quantified) variables. The result is that risk-based decisions tend to be biased in favor of hard, quantifiable (or quantified) evidence and against soft, non-quantifiable (or non-quantified) aspects of risk.

Research Issues

Overall, lack of scientific knowledge and understanding seriously hinders attempts to characterize environmental health risks for the general population and for population subgroups defined by class or race. Quantitative risk assessment in general, and evaluation and resolution of environmental justice issues in particular, are impeded by two common problems (Sexton et al., 1993): (1) lack of adequate and appropriate data, which causes estimation (statistical error in measurements, model parameters, etc.) and omission (misidentification of relevant hazards or causal pathways) errors; and (2) lack of adequate scientific understanding, which causes errors in specification (mistakes in functional forms of models) and extrapolation (misuse of proxy data from analogous contexts). Filling key data gaps by conducting exposure-related, toxicologic, epidemiologic, or clinical studies will reduce estimation and omission errors, while developing and applying mechanistically based methods and models (exposure, pharmacokinetic, pharmacodynamic) will reduce specification and extrapolation errors. In the first instance, research strengthens our ability to estimate risks by enhancing the quality and quantity of data on hand (increased knowledge) and, in the second, it accomplishes the same objective by improving our ability to interpret available data (better understanding).

Environmental health research is needed to reduce critical uncertainties in risk assessment and to provide scientifically credible answers to the risk-related questions posed earlier. In this way, we can rigorously evaluate the differential effects of class and race on environmental health risks and, in the process, build a sound scientific basis for credible, informed decisions about environmental justice. High priority should be given to well-designed scientific studies aimed at characterizing the relationships among (1) class and race, (2) exposure- and susceptibility attributes, and (3) health risks. Equally important is the development and implementation of surveillance systems that provide for systematic, ongoing collection of relevant information (exposure, effects, susceptibility) in economically disadvantaged populations.



Science Policy Issues

In addition to conducting research (generating facts), many environmental health scientists have traditionally played a critical role in science policy (judgments about the use of facts) by serving as technical consultants, peer reviewers, policy advocates, and mediators (Jasanoff, 1990). It is especially important now, as the debate shifts to questions about how to put environmental justice principles into practice that more scientists get involved with this issue. Policy makers can benefit greatly from well-considered expert advice on key science policy issues, like definition of standards of adequacy for scientific evidence, approval of inferences from experiments and studies, certification of study protocols and analytical methodologies, and validation of long-term research strategies (Jasanoff, 1990).

Perhaps most importantly, the lack of scientific certainty about critical risk-related issues relevant to environmental justice puts a premium on scientific consensus. In the face of significant uncertainty regarding issues such as the adequacy of scientific evidence and the appropriateness of inferences from existing data, consensus among a spectrum of respected environmental health scientists can function as a stabilizing factor and intellectual anchor—focusing attention on critical, unresolved scientific questions and lending credibility to related decisions. The more respected scientists get involved in the debate about environmental justice, the less likely it becomes that environmental health principles will be trampled in a rush to political correctness.

Summary and conclusions

Scientific data are currently insufficient to adequately characterize the link between environmental health risks and variables such as socioeconomic status and ethnicity/race. Despite the absence of systematically collected data, there is strong presumptive evidence that low-income communities are routinely both more exposed to environmental hazards and more susceptible to their effects than the general population. Although the ramifications of these disparities for environmental health risks are unclear, there is legitimate reason for concern and ample justification to begin targeted research aimed at answering important risk-related questions.

Because scientific knowledge and understanding are insufficient to answer important environmental justice questions with adequate certainty, there continues to be controversy about whether decision makers (regulators, risk managers) have the facts right. Without a firm scientific foundation, stakeholders worry that decisions are more likely to be driven by political agendas, special interests, and media pressure. An obvious solution is to invest

adequate resources in targeted research and surveillance. The goal must be to reduce the most critical scientific uncertainties currently limiting our ability to estimate health risks realistically for economically disadvantaged populations and people of color.

In the past, the field of environmental health sciences has been instrumental in helping us apply public health principles to the management of pollution hazards, both by generating relevant facts and aiding in judgments about the use of facts for policy. Today, environmental health scientists need to pay more attention to issues of environmental justice, undertaking well-designed research studies to produce pertinent facts and participating in decisions about their applicability and utility for policy. In the future, the field of environmental health sciences will be successful in fostering informed, reasonable, and credible decisions about environmental justice in direct proportion to its success at improving our ability to assess health risks realistically for all members of society.

Acknowledgments

The risk-based context for environmental justice is discussed in more detail in two articles that served as a foundation for this piece: Sexton et al. (1993) and Sexton (1997). For an environmental justice advocacy perspective on risk assessment, the reader is referred to Kuehn (1996). We thank the two reviewers who provided helpful comments on an earlier version of the manuscript. The authors were partially supported by EPA grant number 825241-01-0.

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